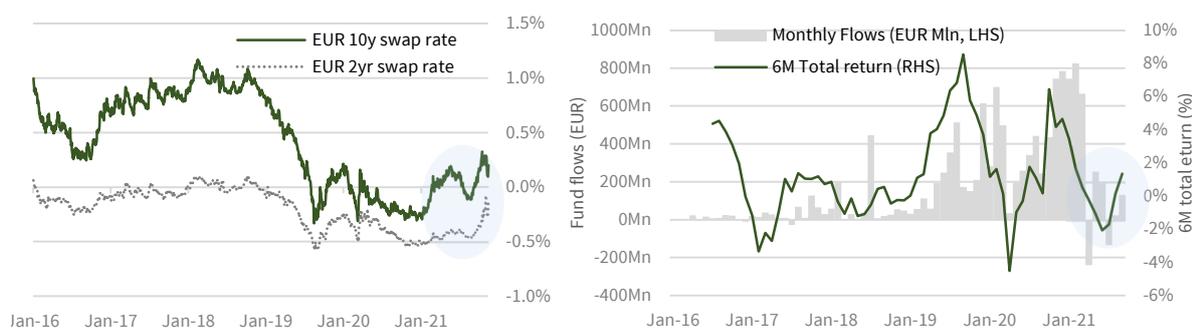


Green bond funds in a rising rates environment

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With recent rises in interest rates, with both US and German 10yr yields moving up by around 50bp between early August and early November, investors across all asset classes are assessing their sensitivity to rates. For climate focused fixed income investors, a natural question is how green bonds behave in this new territory. Since the real inception of the green bond market in 2013, EUR rates have rarely been put on an upward trajectory similar to the recent one (see Figure 1, left hand panel).

Figure 1. 2021: rates up, negative GBF total returns and slowing inflows to GBF. Source: AFII, Morningstar, Bloomberg



In this note, we analyze the interest rate sensitivity of the bigger EUR denominated green bond funds as a proxy for the whole asset class. There has been solid growth in both fund launches and AUMs (see Figure 1, right hand panel). One can suspect that the duration risk could be substantial in this space, as the growth in AUM has come during a bullish rates environment, where bond issuers have been able to extend across the curve. Also, green bond issuers tend to be low-spread names, further increasing duration exposure.¹

Not surprisingly, our analysis finds that Green Bond Funds (GBF) total returns have high rates correlation, especially with the long end of the rates curve. **The implication of this is that total return investors allocating into green bonds should indeed keep a close eye on what interest rate exposure they want in their green bond portfolio.**

With new sovereign issuers coming to the market, one could expect GBFs' total returns to increase even more in correlation with the underlying sovereign duration-based returns. However, when looking at the changing composition of the GB universe, we see increasing sovereign issuances being matched by more corporates, and a shrinking SSA relative issuance. **This issuance 'barbell' may actually be neutral for GBFs' exposure to interest rate rather than credit risks.**

¹ For the non-technical reader, higher risk bonds, such as in high-yield, have lower government bond interest rate sensitivity. Intuitively, this comes from HY bonds having a significantly higher risk of default.

Measuring duration risks through historical total returns

For various reasons, analytically produced duration numbers on bond funds may differ across time and depending on the exact investment strategy. Thus, in order to gauge actual interest rate risk in a sample of green bonds funds, looking at historical correlations in total returns can give a fuller picture of duration risks over the cycle.

Figure 2. The 5 biggest GBF domiciled in Europe. Source: AFII, Morningstar.

Fund Name	Size (EUR Mil)	Morningstar Category	Factsheet Duration*
iShares Green Bond Index Fund**	2851.08	Global Bond - EUR Hedged	8.28
Eurizon-Fund - Absolute Green Bonds	2314.37	Global Bond	3.17
NN (L) Green Bond	1423.47	EUR Diversified Bond	9.32
AXA World Funds - ACT Global Green Bonds	1198.78	Global Bond - EUR Hedged	7.4
BNP Paribas Funds Green Bond Privilege	1117.31	Global Bond - EUR Hedged	7.19
The Bloomberg Global Aggregate Bond Index – EUR Hedged	NA	NA	7.35

*as of September, 2021

Our sample consists of the larger green bond funds denominated in EUR (further details in Figure 2 above), whose total returns we compare with the Bloomberg Pan-European Treasury aggregate total returns in different maturity buckets, using a methodology called ‘partial least squares’ (PLS) which is explained further below.² Funds in the sample are either denominated in EUR or have EUR-hedged share classes. Each respective fund’s duration as suggested by their factsheets are also tabulated. We have then compared the total return time-series for each fund with the total returns of a EUR government bond benchmark (which) in order to determine which part of the curve the GBFs are mostly correlated to.

Figure 3 shows the results from the PLS analysis³, highlighting how GBF sensitivity to 7y-10y and 10y+ interest rates is significantly higher with respect to the long end of the rates curve rather than the short end. For comparison reasons, we add a broad benchmark, the Bloomberg Global Aggregate bond index, where we note that most of the GBFs in question have higher correlations with rates returns than the Agg index (as measured by explained variance).

The approach only indicates to us to which part of the curve the GBFs are most correlated, but it does not give us numbers on the actual sensitivity (the ‘beta’) to rates at that point. The above results also led us to explore the specific relationship of each fund with the 7y-10y and 10y+ benchmarks through linear regressions. Results are presented in Figure 4 and Figure 5.

² Traditional multivariate regression models run into issues of multicollinearity when running term-structure regressions like this. Partial Least Square Regressions is one way to get around this issue. Although it bears some similarities to Principal Component Analysis, it is a supervised method which aims to maximize the covariance between explanatory and response variables. Through an iterative algorithm, the model builds a new set of “latent” variables (which are a linear combination of the explanatory variables) that best model the response variable. Please refer to *An Overview of Partial Least Squares*, Dante M. Pirouz, Octobre 2006.

³ We use Variable Importance in Projection (VIP metric for this purpose: it summarizes the contribution a variable makes to explain the variance in the model.

What comes out of these regressions are surprisingly low betas with the 10y+ rate curve (in the range between 0.20-0.35), with the interpretation that the green bond funds only capture a relatively small amount of the volatility in the long-end rates movements. A similar regression but on the 7-10yr parts of the rates curve gives significantly higher betas, in the range of 0.7. Note that if the green bond fund returns moved in lock-step with rates, the beta would be 1.

Figure 3. Partial Least Square (PLS) regressions of GBF on the EUR Rate Curve. Daily returns since funds' inception. Source: AFII, Bloomberg.

Fund Name	Explained Variance – R2	Variable Importance in Projection (VIP)				
		10y+*	7y - 10y*	5y - 7y*	3y - 5y*	1y - 3y*
iShares Green Bond Index Fund**	62%	1.3	1.2	1.1	0.8	0.4
Eurizon-Fund - Absolute Green Bonds	46%	1.03	1.13	1.1	0.96	0.73
NN (L) Green Bond	58%	1.3	1.2	1.1	0.8	0.4
AXA World Funds - ACT Global Green Bonds***	50%	1.3	1.24	1.06	0.73	0.33
BNP Paribas Funds Green Bond Privilege	62%	1.2	1.2	1.1	0.8	0.5
Global Agg**	45%	1.4	1.3	1.0	0.6	0.2

*1-3y: I02526EU Index, 3-5y: I02527EU Index, 5-7y: I02528EU Index, 7-10y: I02529EU Index, 10y+: I02530EU Index

**The Bloomberg Global Aggregate Bond Index – EUR Hedged

*** USD share class

Figure 4. GBFs linear regressions on 10y+ EUR Rate Curve. Source: AFII.

Fund Name	10y+ Intercept	Intercept t-stat	10y+ Beta	Beta t-stat	Explained Variance – R2
iShares Green Bond Index Fund	0.003	1.13	0.33	60.64	77%
Eurizon-Fund - Absolute Green Bonds	0.004	1.06	0.19	24.6	41%
NN (L) Green Bond	0.004	1.13	0.38	59.13	71%
AXA World Funds - ACT Global Green Bonds	0.002	0.60	0.28	49.34	64%
BNP Paribas Funds Green Bond Privilege	-0.003	-1.07	0.3	55.08	75%
Global Agg	0.003	1.03	0.23	48.95	62%

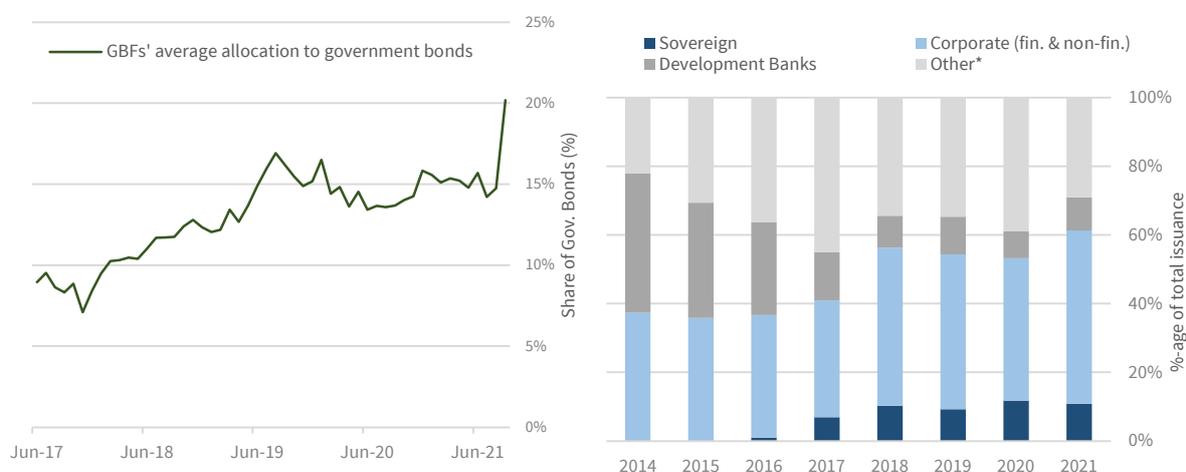
Figure 5. GBFs linear regressions on 7y-10y EUR Rate Curve. Source: AFII.

Fund Name	7-10y Intercept	Intercept t-stat	7-10y Beta	Beta t-stat	R2
iShares Green Bond Index Fund	0.014	0.54	0.72	51.62	71%
Eurizon-Fund - Absolute Green Bonds	0.003	0.83	0.47	28.84	49%
NN (L) Green Bond	0.003	0.81	0.83	54.13	67%
AXA World Funds - ACT Global Green Bonds	0.002	0.50	0.58	43.48	58%
BNP Paribas Funds Green Bond Privilege	-0.004	(1.23)	0.65	49.50	71%
GLOBAL AGG	0.002	0.79	0.47	38.40	50%

Shifts in GBF sector allocation – driving more interest rate risk exposure?

Our historical analysis so far finds significant but not overwhelming co-dependency between GBFs and government bond return. However, considering the young nature of the GB market, recent and forthcoming changes in its structure may change these correlations. According to Climate Bonds Initiative (CBI)⁴, the sovereign green bonds market has experienced a significant growth compared to the private sector in 2020 whilst development banks' market share has been dropping from 41% in 2014 to 8% in 2020. A number of large, sovereign issuers have entered the market in the past 12 months, such as the German, Italian and UK governments. Add to this the European Unions stated intentions to issue up to €250 billion in green bond format over the next few years.⁵

Figure 6. GBF allocations have shifted alongside the evolution of the green bonds market structure. Source: AFII, Morningstar, CBI.



Changes in the green bonds market structure have been reflected in GBF sector allocations. According to Figure 4, Government bonds' share has doubled since 2017, accounting on average for more than 20% of GBF portfolios as of September 2021.

However, on a relative basis, the rise in sovereign appears to not have been driven by lower corporate issuance, but lower issuance from development banks, especially in 2021. Given that development banks often are considered an in-between between sovereigns and corporates, it is not certain that growing sovereign issuance will drive greater direct interest sensitivity in GBFs.

⁴ <https://www.climatebonds.net/market/data/>

⁵ https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5207

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